Claims

1. A radially expandable intraluminal stent in the form of a generally tubular wall having open regions that define wall structure comprising:

a plurality of nodes, each node having a central hub and three arms extending from the hub, each arm circumscribing the hub and a segment of the next adjacent arm of that node;

each arm being connected, at a transition region, to an arm of an adjacent node, the connected arms of the adjacent nodes defining a link between those nodes.

2. A stent as defined in claim 1 wherein the arms in said links of adjacent nodes curve in opposite directions.

3. A stent as defined in claim 1 wherein the links are S-shaped.

4. A stent as defined in claim 1 where a plurality of nodes are arranged in a hexagonal cluster.

5. A stent as defined in claim 4 wherein the hexagonal clusters are oriented so that none of the adjacent pairs of nodes is aligned in a direction that parallels the longitudinal axis of the stent.

6. A stent as defined in claim 4 wherein the hexagonal clusters are oriented so that none of the adjacent pairs of nodes is aligned in a circumferential direction.

7. A stent as defined in claim 1 wherein the arms of the nodes are arranged generally to define a spiral

8. A stent as defined in claim 7 wherein the gap between adjacent arms of a spiral is of substantially constant width up to the transition region.

9. A stent as defined in claim 1 wherein each of the arms of a node is connected at a root to the hub of the node and where the roots are equiangularly spaced about the hub.

10. A stent as defined in claim 1 wherein each arm of each node is connected to a different one of the adjacent nodes.

11. A stent as defined in claim 1 further comprising:

the nodes being arranged so that a plurality of adjacent pairs of nodes lie along radially extending planes, the planes being spaced along the length of the stent.

12. A stent as defined in claim 11 wherein the links between the nodes of said pairs thereof lie along the radial planes and extend in a circumferential direction.

13. A stent as defined in claim 12 further comprising additional pairs of adjacent nodes extending along a row that extends generally helically along the stent.

14. A stent as defined in claim 1 further comprising:

the nodes being arranged so that a plurality of adjacent pairs of nodes lie along a row extending longitudinally of the stent.

15. A stent as defined in claim 14 wherein the nodes are arranged to define a plurality of said longitudinally extending rows.

16. A stent as defined in claim 1 wherein the transition region is disposed at the midportion of the link.

17. A stent as defined in claim 1 formed from a metal having sufficient ductility to plastically deform in response to application of a radially outward expansion force applied to the stent.

18. A stent as defined in claim 1 formed from a material having sufficient inherent resilience to cause the stent to itself expand from a low profile diameter to an expanded diameter.

19. A stent as defined in claim 1 formed from a metal having shape memory characteristics adapted to enable the stent to expand in response to a thermal event.

20. A stent as defined in claim 1 having low profile and expanded diameters and being dimensioned to enable the stent to be delivered into and deployed within a human biliary duct.

21. A stent as defined in claim 1 having low profile and expanded diameters to enable the stent to be delivered into and deployed within a blood vessel.

22. A stent as defined in claim 1 having low profile and expanded diameters and being dimensioned to enable the stent to be delivered into and deployed within a urological passage.

23. In a radially expandable tubular intraluminal stent defined by and having a plurality of interconnected members deformable to a larger diameter tubular configuration, the improvement comprising a plurality of nodes, each defined by a central hub and three arms, each of the arms in each of the nodes having a portion that circumscribes the hub and a segment of an adjacent arm of that node.

24. A stent as defined in claim 23 wherein the three-armed nodes are arranged in general alignment along a plurality of helically extending rows, two of the arms of each link being connected serially to adjacent nodes along its associated helical row, the third arm of the node being connected to a node that lies along the next adjacent helical row.

25. A stent as defined in claim 24 wherein the third link of succeeding nodes lying along a helical row are connected to nodes in alternately adjacent helical rows.

26. A stent as defined in claim 16 further in which the arms define a generally spiral configuration.

27. A stent as defined in claim 26 wherein the nodes are arranged in clusters of six nodes each.

28. A stent as defined in claim 26 wherein the nodes are arranged along a

plurality of helical rows, the nodes in each row being serially connected to each other by a link, each of the nodes in each helical row also being connected, by a link, to a node in each adjacent helical row.

29. A stent as defined in claim 16 wherein the paralleling relation extends over a substantial arc.

30. A radially expandable intraluminal stent in the form of a generally tubular wall having cut out regions that define wall structure comprising:

a plurality of interconnected links deformable to enable the stent to expand from a small diameter to a larger diameter in response to expansion of an expanding member within the stent;

the links disposed at the opposite ends of the stent being interconnected to provide greater resistance to radial expansion of the end regions of the stent than at the intermediate region of the stent.

31. A stent as defined in claim 30 wherein said interconnection further comprises:

a plurality of nodes extending circumferentially about an end of the stent and defining the end most radial plane of nodes,

an arm of each of a pair of adjacent nodes in the radial plane each having extensions thereof that are connected to each other at a transition region, one of the extensions being formed to define a male contour and the other of the extensions being formed to define a female contour receptive to member having said male shaped contour.

32. A stent as defined in claim 31 further comprising a portion of the male member defining a socket receptive to a portion of the arm defining the female socket.

33. A stent as defined in claim 32 wherein the male and female members are L-shaped.

34. A radially expandable intraluminal stent in the form of a generally tubular wall having cut-out regions that define wall structure comprising:

a plurality of interconnected links deformable to enable the stent to expand from a small diameter to a large diameter in response to expansion of an expanding member within the stent;

means at the ends of the stent for providing greater resistance to radially expansion of the ends region of the stent than at the intermediate region of the stent, at least during the initial portion of said expansion.

35. A radially expandable intraluminal stent in the form of a generally tubular wall having cut out regions that define wall structure comprising:

a plurality of nodes, each node being connected to adjacent nodes by an individual generally S-shaped link;

the links and nodes being arranged so that when the stent is expanded from its initial diameter to an expanded diameter, the circumferentially oriented links will elongate to a greater degree than the links oriented in a less circumferential direction.

36. In a radially expandable tubular stent having a wall defined by and having a plurality of interconnected links deformable from a low profile diameter to an expanded diameter, the improvement comprising a plurality of nodes, each node having

a central hub and three arms extending from and circumscribing the hub and a segment of the next adjacent arm of that node, the arms being of sufficient length to flex to permit the central hub to be displaced transversely with respect to those regions of the stent wall that surround the radially displaced node.

37. A stent as defined in claim 1 wherein each cluster is formed from six nodes.

38. A stent as defined in claim 1 further comprising the nodes being arranged in clusters of 6 in which two arms of each node are connected to nodes of that cluster and one arm of each of the nodes in that cluster is connected to a node of another cluster.

39. A stent as defined in claim 38 wherein each of the nodes in the stent is shared by three adjacent clusters.

40. A method for making a balloon expandable tubular stent adapted to be placed on a balloon and then crimped about a balloon to a low profile for delivery comprising:

initially forming a tubular stent in a diameter equal to that of the desired low profile after the stent is crimped onto the balloon;

whereby the diameter of the stent can be increased to enable insertion of the balloon of a balloon delivery device into the slightly expanded stent and

then crimped to return the stent to its original low profile configuration on the balloon.

41. A method as defined in claim 40 wherein the tubular stent is made from an initially solid walled tube.

42. A method for assembling a tubular stent on a balloon comprising:

providing a balloon catheter with a defined low profile about which the stent can be crimped;

forming a stent with an unstressed diameter equal to the crimped diameter;

expanding slightly the stent;

inserting the balloon into the slightly expanded stent; and

crimping the stent onto the balloon to reduce it to its low profile.

43. A method as defined in claim 42 wherein the expansion of the stent is to a degree that is a small fraction of the fully expandable diameter of the stent.

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